

Docket No.: SB-514

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
Before the Board of Patent Appeals and Interferences

Applic. No. : 10/533,560 Confirmation No.: 4363  
Inventor : Gebhard Zobl, et al.  
Filed : May 2, 2005  
Title : Process for Producing a Molding  
TC/A.U. : 1731  
Examiner : Russell J. Kemmerle  
Customer No. : 24131

**BRIEF ON APPEAL**

This is an appeal from the final rejection in the Office action dated July 6, 2007, finally rejecting claims 8 - 15.

Appellants submit this *Brief on Appeal* in triplicate, including payment in the amount of \$510.00 to cover the fee for filing the *Brief on Appeal*.

Real Party in Interest:

This application is assigned to Plansee SE of Austria. The assignment is recorded at Reel/Frame number is 017537/0123.

Related Appeals and Interferences:

No related appeals or interference proceedings are currently pending which would directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

Status of Claims:

Claims 8 - 12 are finally rejected and are under appeal. Claims 1 - 7 have been canceled. Claims 13-15 are not specifically rejected. However, the Examiner did not specifically indicate that claims 13-15 are allowable.

Status of Amendments:

The claims were not amended after the final rejection.

Summary of the Claimed Subject Matter:

Claim 8 defines a process for producing a molding with a basic body (5; Fig. 1). The basic body has a multiplicity of elevations (4, 3; Fig. 1 and Figs. 2-3B) merging into the basic body (5) with inclined side surfaces (all figures). The claimed method includes the following steps:

providing powdery raw materials selected from the group consisting of metallic materials and ceramic materials (page 6, lines 1-21; original claim 6) and pressing the powdery raw materials in a two-stage pressing operation with a first pressing stage and a second pressing stage (page 3, lines 20-36); and

in the first pressing stage, pressing boundary surfaces of the basic body to near final shape as far as transition regions of the elevations and simultaneously pressing the elevations to an oversize, defined with a projection height  $h'$  from the basic body being greater than a projection height  $h$  from the basic body in a finally pressed state by 10% - 150%, and with side surfaces of the elevations enclosing an angle of inclination  $\alpha'$  in a range from 90° - 150° with a respectively adjacent boundary surface of the basic body (page 3, lines 22-31; Production Example, page 7, line 26, to page 8, line 7), and

in the second pressing stage, pressing the elevations to near final shape, with the angle of inclination  $\alpha'$  increased to a value  $\alpha$  in a range from 95° - 170° (page 3, lines 33-36; Production Example, page 8, line 9, to page 9, line 14); and

subsequently sintering the basic body to produce the molding (page 8, bottom; page 9, lines 12-14).

In more general terms, the invention relates to a process for producing a molding that comprises a disk-like or plate-like basic body having a large number of knob-like and/or web-like elevations which merge into the basic body with inclined side surfaces. A powdery raw material is thereby pressed and sintered close to the final shape.

#### Grounds of Rejection to be Reviewed on Appeal

1. Whether or not claims 8 - 12 are obvious over Yoshida et al. (US 6,660,420, hereinafter "Yoshida") in view of Koga (US Patent 6,517,338) and Quadakkers et al. (US 5,733,682, hereinafter "Quadakkers") under 35 U.S.C. § 103.

Argument:

The rejection over Yoshida in view of Koga under Quadakkers under 35 U.S.C. § 103 is in error. We will point out in the following that the claimed invention, as defined in claim 8, is indeed patentable over the prior art.

Yoshida describes a separator for a fuel cell. The separator is produced from graphite powder. The graphite particles are bound by a thermosetting resin. During the production of the separator body, the base mixture of the graphite and the resin is formed in a two-stage pressing process into final shape. Such a mixture is easily brought into final shape. The separator achieves its necessary rigidity and density when the resin cures at a slightly elevated temperature in the range from 150°-170°C during the second pressing stage. Reference is had to the disclosure in Yoshida at col. 1, lines 44-50; col. 4, lines 49-51; and col 6, line 51, to col. 7, line 4.

By way of example:

[T]he preliminary molded member is then placed in a mold 14 having a predetermined final shape (step S102).

Under this state, the mold 14 is heated to 150 to 170°C., and a pressing machine . . . producing the separator 4 having the final shape which corresponds to the shape of the mold 14 (step S104).

In the separator 4 . . . while heating the mold to 150 to 170° C. Therefore, the thermosetting resin melts and a thermosetting reaction occurs, with the result that the preliminary molded member can be uniformly molded into the separator 4 in which the mold density is high, and which has a predetermined shape.

Yoshida, col. 6, line 49, to col. 7, line 4.

Yoshida's process is entirely different from the claimed process, where powder mixtures are processed that are very difficult to press. Yoshida presses graphite in

a matrix of about 10-40% resin. Such mixtures are very easy to press and to mold.

See, col. 7, lines 5-15. The powders of the claimed invention are metals and/or ceramics. Claim 13 includes chromium (Cr) in the powder. These materials are extremely difficult to press. Subsequent to the second pressing stage, the near-final-shape pressed body must be subjected to sintering so as to assure the structural rigidity and sufficient density of the article.

Appellants will not, however, rely solely on the foregoing argument. Instead, we respectfully point to the prior art reference Quadakkers, which describes the pertinent state of the art. Where complex forms such as separators (interconnectors, bipolar plates) for fuel cells are to be formed of chromium-containing alloys, there are two processes available in the art, to wit:

The typical form of the plate which can be several millimeters thick with gas channels can be manufactured by conventional machining of sheet material or it can be fabricated by a process yielding a shape close to the final form (near-net-shape process) by powder metallurgical methods (MIM, WPP).

Quadakkers, et al., col. 3, lines 34-38. That is, where powder is used, only MIM (metal injection molding) or WPP (wet powder pouring) is available to the person of ordinary skill in the art. The primary disadvantage of these processes is their requirement for a high content of binder. Shrinkage and/or pore formation during the subsequent sintering process cannot be avoided.

In other words, the prior art does not teach molding to near final shape in a two-stage press where metal and/or ceramic powders are used as the starting

materials. Instead, the only powder metallurgical processes that are considered are MIM and WPP.

The secondary reference Koga does not properly modify Yoshida to reach the claimed invention either. There, separators are also produced from graphite powder mixtures with a thermosetting resin, and the body is compressed to assure the required gas-tightness. According to Koga:

The separator 104 is constructed from a gas impermeable conductive member such as of a molded carbon article formed of an electrically conductive carbon material compressed for reduced gas permeability.

Koga, col. 1, lines 32-35. See, also, col. 4, lines 26-32, where Koga describes adding thermosetting resin (e.g., phenolic resin) so as to improve the molding composition.

The person of ordinary skill in art who attempts to produce an intricately shaped body with powder-based metallic (and/or ceramic) materials and press the same into near-final shape is not guided towards the claimed invention. Instead, the artisan is unambiguously directed to MIM or WPP as the only readily suitable processes.

This is where appellants' inventive spirit is evident. The process according to the invention is based on the concept of enabling the formation of intricate shapes in a power-pressing process by providing for the detailed two-stage pressing with carefully controlled press shaping. The claimed formation of the angles and the dimensions of the elevations between the two pressing stages and the final shaping

is neither shown nor suggested in the prior art. The processes using graphite powders and thermosetting resin, and the fact that such easily molded materials may be formed to the shapes and dimensions as claimed, cannot render the claimed invention unpatentable. Appellants are the first to disclose and claim an unobvious invention where metallic and/or ceramic powders are pressed and sintered into final shape, as claimed.

Appellants respectfully submit that the combination of Yoshida, Koga, and Quadakkers can be arrived at only with “hindsight” and that the alleged obviousness of the combination is entirely artificial and finds no basis in the prior art. In order to guard against such an impermissible combination, we must review the state of the art as it existed prior to the invention. The “objective” starting point – as viewed by the person of skill in the art prior to August 1, 2002 – was as follows:

The person of skill in the art was well aware of the difficulties concerning the pressability of chromium-containing powder mixtures. The person of ordinary skill in the art would therefore – virtually by definition – proceed as was conventional in producing form parts for interconnectors of fuel cells. The person of ordinary skill in the art would necessarily have utilized the conventional processes described by Quadakkers, i.e., MIM or WPP, which do not require pressing.

The person of skill in the art would not have considered employing the special pressing processes described by Yoshida and Koga, where easily pressable graphite powder is used (which, by the way, does not require sintering after pressing) to press chromium powders (which do require sintering after pressing).

The skilled artisan would not have considered it, because success was not predictable and entirely unexpected.

Not only was there absolutely no suggestion to combine, but appellants have proven with the foregoing facts that the combination of these teachings was entirely non-obvious and there existed several obvious reasons why a person of ordinary skill in the art would not have combined the teachings.

None of the prior art references of record, whether taken alone or in any combination, either show or suggest the features of claim 8. Claim 8 is, therefore, patentable over the prior art.

The honorable Board is respectfully urged to reverse the final rejection.

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Claims Appendix:

Claim 8. A process for producing a molding with a basic body having a multiplicity of elevations merging into the basic body with inclined side surfaces, the method which comprises the following steps:

providing powdery raw materials selected from the group consisting of metallic materials and ceramic materials and pressing the powdery raw materials in a two-stage pressing operation with a first pressing stage and a second pressing stage; and

in the first pressing stage, pressing boundary surfaces of the basic body to near final shape as far as transition regions of the elevations and simultaneously pressing the elevations to an oversize, defined with a projection height  $h'$  from the basic body being greater than a projection height  $h$  from the basic body in a finally pressed state by 10% - 150%, and with side surfaces of the elevations enclosing an angle of inclination  $\alpha'$  in a range from 90° - 150° with a respectively adjacent boundary surface of the basic body, and

in the second pressing stage, pressing the elevations to near final shape, with the angle of inclination  $\alpha'$  increased to a value  $\alpha$  in a range from 95° - 170°; and

subsequently sintering the basic body to produce the molding.

Claim 9. The process according to claim 8, which comprises forming the basic body as a disk-shaped or plate-shaped basic body, and forming the elevations as knob-shaped and/or web-shaped elevations.

Claim 10. The process according to claim 8, which comprises forming the projection height  $h'$  by 30% - 100% greater than the final projection height  $h$  in the finally pressed state.

Claim 11. The process according to claim 8, which comprises forming the angle of inclination  $\alpha'$  within a range from  $110^\circ$  to  $130^\circ$ , and forming the angle of inclination  $\alpha$  within a range from  $115^\circ$  to  $160^\circ$ .

Claim 12. The process according to claim 8, which comprises pre-sintering subsequently to the first pressing stage.

Claim 13. The process according to claim 8, which comprises forming the molding from an alloy having at least 20% by weight of chromium component.

Claim 14. The process according to claim 13, wherein the alloy contains the chromium component, an iron component, and one or more additional metallic and/or ceramic alloy components of a total of at most 40% by weight, and which comprises introducing the additional alloy components into the powdery raw materials as a pre-alloy with at least one of chromium and iron.

Claim 15. The process according to claim 13, which comprises forming the molding as an interconnector of a fuel cell.

Evidence Appendix:

No evidence pursuant to §§ 1.130, 1.131, or 1.132 or any other evidence has been entered by the Examiner and relied upon by appellant in the appeal.

Related Proceedings Appendix:

No prior or pending appeals, interferences or judicial proceedings are in existence which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in this appeal. Accordingly, no copies of decisions rendered by a court or the Board are available.